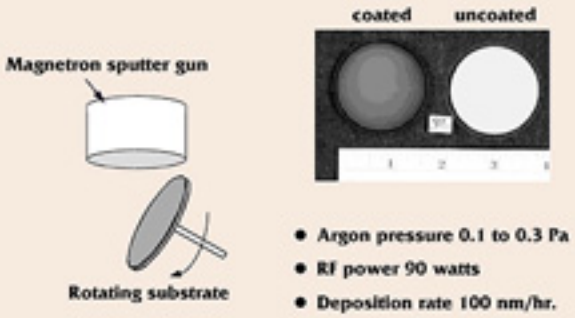
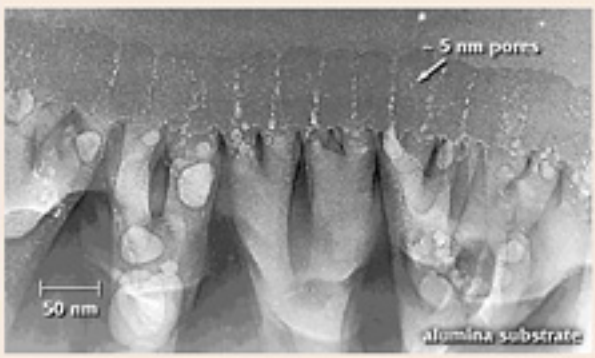
Membrane Systems for Energy Efficient Separation of Light Gases

Oblique Angle Magnetron Sputtering



- Argon pressure 0.1 to 0.3 Pa
- RF power 90 watts
- Deposition rate 100 nm/hr.
- Rotation - uniform coverage and straight pores

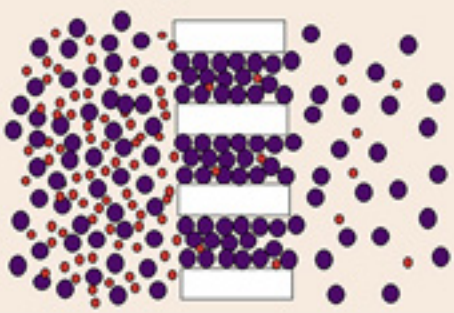
Oblique Angle Deposition by Magnetron Sputtering with Substrate Rotation



Deposition System

Capillary Condensation

Condensation of Hydrocarbons in Mesoporous Materials



The goal of this CRADA is to demonstrate the economic, technical and commercial potential of a light gas separation process based on novel inorganic membranes. If successful, the end-result of this project will be the design of a commercially scalable pilot plant.

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Membrane Systems for Energy Efficient Separation of Light Gases

Ethylene and propylene are two of the largest commodity chemicals in the U.S. and are major building blocks for the petrochemicals industry. These olefins are separated currently by cryogenic distillation which demands extremely low temperatures and high pressures. Over 75 billion pounds of ethylene and propylene are distilled annually in the US at an estimated energy requirement of 400 trillion BTU's. Non-domestic olefin producers are rapidly constructing state-of-the-art plants. These energy-efficient plants are competing with an aging US olefins industry in which 75% of the olefins producers are practicing technology that is over twenty years old. New separation opportunities are therefore needed to continually reduce energy consumption and remain competitive. Amoco has been a leader in incorporating new separation technology into its olefins facilities and has been aggressively pursuing non-cryogenic alternatives to light gas separations. The largest area for energy reduction is the cryogenic isolation of the product hydrocarbons from the reaction by-products, methane and hydrogen. This separation requires temperatures as low as -150°F and pressures exceeding 450 psig. This CRADA will focus on developing a capillary condensation process to separate olefinic mixtures from light gas byproducts at temperatures that approach ambient conditions and at pressures less than 250 psig; this technology breakthrough will result in substantial energy savings. The key technical hurdle in the development of this novel separation concept is the precise control of the pore structure of membrane materials. These materials must contain specially-shaped channels in the mesopore range to provide the driving force necessary to remove the condensed hydrocarbon products. In this project, Amoco is the technology end-user and provides the commercialization opportunity and engineering support. Los Alamos National Laboratory provides the material development expertise that is critical for achieving the desired product separation.

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